American Fern Journal 79(4): 127–135 (1989)

The *Cheilanthes dichotoma* Group of South America

M. Mónica Ponce
Instituto de Botánica Darwinion, Casilla de Correo 22, 1642 San Isidro, Argentina

Marta A. Morbelli
Facultad de Ciencias Naturales y Museo, UNLP, Paseo del Bosque s. n., 1900 La Plata, Argentina

During the course of the study of Pteridophyta for the Flora of the Province of San Juan, Argentina, directed by R. Kiesling, several taxonomic novelties have appeared, among them, a new species of *Cheilanthes*. In order to find the taxonomic position of this species, related species were examined. These species had not been grouped by Tryon and Tryon (1982, pp. 251–255) in their informal classification of species groups in *Cheilanthes*. Because their characters did not allow inclusion in any of these groups, a new group is proposed.

The systematics of the cheilanthoid ferns is being studied by many authors using cytological and electrophoretical data, in order to find more coherent classifications of these complex taxa (Vida et al., 1983; Gastony & Windham, 1987; Wollenweber, 1985; Windham, 1986, 1987; Benham et al., 1988). Recently, *Argyrochosma* and *Astrolepis* were separated from *Notholaena* (Windham, 1987; Benham et al., 1988). However, a modern taxonomic treatment is still necessary in *Cheilanthes*. In fact, this large genus has recently been extended by additions of species formerly placed in *Adiantopsis*, *Doryopteris*, and *Notholaena* (Tryon & Tryon 1982, pp. 267, 272, 296).

Materials and Methods

Collections in BA, BAB, BAF, GH, HBR, ICN, LP, MBM, PACA, and SI and type specimens at K, P, SI, and W, were studied. Ecological and geographical information was obtained from herbarium labels and field data.

The following characters were used to distinguish and group the species: rhizome type; rhizome and basal stipe scales; stipe and rhachis sections; axis color and direction; blade division; venation; stipe, rhachis, and blade indument; sorus position; and spore wall (sculpture and structure).

Spores from herbarium material were studied with LM and SEM. For light microscopy, material was acetolized by Erdtman's technique, preceded by treatment with hot sodium carbonate (3%) for 2 minutes, with the aim of not destroying the perispore. Slides for study with LM were mounted in glycerine jelly. An Olympus BH2 microscope was used. For the SEM, material was treated with sodium carbonate, washed and suspended in 96% ethanol, then transferred to acetate plates and later coated with gold. A JEOL JSMT-100 SEM was used.

Results and Discussion

The *Cheilanthes dichotoma* group is defined by a combination of morphological characters: stipe dark reddish brown, subterete; rhachis the same color, sulcate, with short and sclerotic ribs or narrow hyaline wings; pinnae petiolulate, ultimate segments lobed, the lobes reflexed and contracted, the vein-tips unmodified to slightly enlarged; axes and lamina glabrate or with minute glandular hairs, these 1–3-celled with a yellow, rusty, or red head; sori terminal on the veins.

The spores are the predominant type present in *Cheilanthes* (Tryon & Tryon, 1973, 1982), and therefore do not distinguish the *Cheilanthes dichotoma* group; however, their sculpture is homogeneous within it (Fig. 1). The spores are trilete, globose, or subglobose, and yellow, tan, or olive. The exospore, brown in acetolized material, is smooth; the perispore, pale yellow in acetolized material, is either cristate or cristate-reticulate. In transverse view the perispore shows two different structures: 1) an inner reticulate stratum limited by a thin lamella, on whose surface the cristae are arranged (Fig. 1b1); 2) a structure where there is no boundary between the inner stratum and the surface. In the latter case the cristae are formed by the expansion and fusion of the threads of the inner reticulum (Fig. 1c1). The microsculpture between the cristae is smooth, perforate, or reticulate.

Distribution. The group is Neotropical and is distributed from Ecuador to southern Brazil and Mendoza (Argentina) near 35° south. The Chaco region in Paraguay and Argentina contains three of the species, and from there come most of the collections (Fig. 2).

Ecology. *Cheilanthes dichotoma*, *C. orbignyana*, and *C. tweediana* inhabit mainly the edges of deciduous forest, xerophyllous forest, or brushwood, or in fields, often between terrestrial bromeliads, or in palm formations. In these seasonally dry subtropical habits, natural fires are frequent. The species grow in stony, rocky, and also swampy or halophilous soils. *Cheilanthes sarmientoi* grows in the most arid habitats with extreme temperatures, in rocky crevices, and in the shade of vegetation or rocks.

Relationships. The *Cheilanthes dichotoma* group is closely related to the *C. marginata*, *C. microphylla*, and *C. micropteris* groups of Tryon and Tryon (1982, pp. 251, 253, 255). The *C. dichotoma* group shares with these groups 2–5-pinnate fronds; dark, castaneous stipe; lanceolate to ovate lamina; glabrous or hairy lamina with the hairs simple or glandular; and oblong, elliptic to ovate or orbicular ultimate segments.

The *C. marginata* group differs by its glabrous lamina with sometimes papillate margin modified into a false indusium, this confined to the fertile segments or extending along the costae. The *C. microphylla* group differs by its dark brown to black, terete axes, with whitish to reddish, pluricellular simple hairs, and often hairlike scales. The *C. micropteris* group differs by its reddish brown, terete stipe and dense, pluricellular, glandular hairs covering the whole frond.

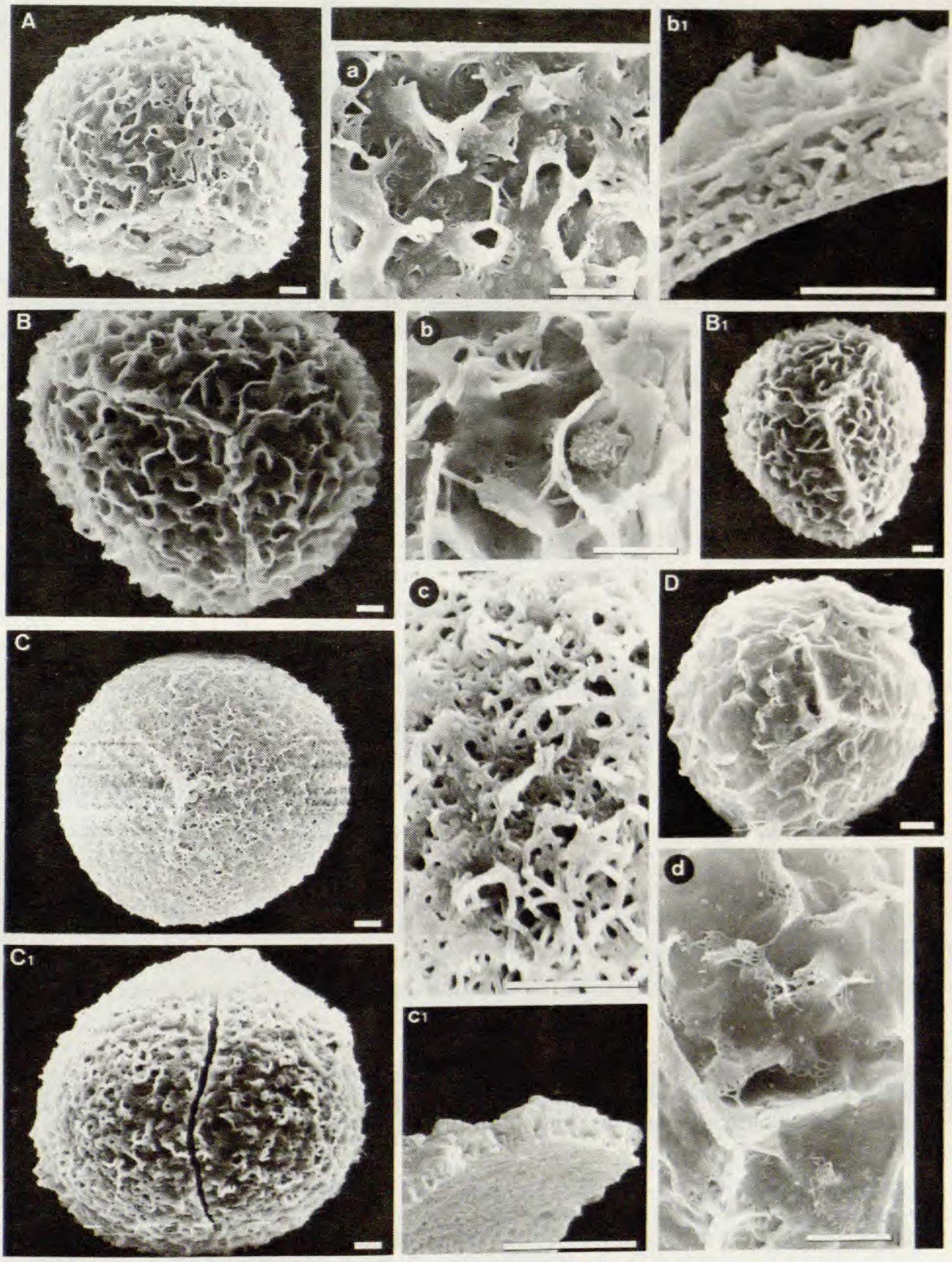


FIG. 1. Spores of the *Cheilanthes dichotoma* group. A, a. *Cheilanthes dichotoma* (*Osten 5697*, SI). B,B1,b,b1. *Cheilanthes orbignyana* (*Rojas 3006*, SI). C,C1,c,c1. *Cheilanthes sarmientoi* (*Kiesling & Sáenz 4175*, SI). D, d. *Cheilanthes tweediana* (*Schulz 6*, SI). All scales = 5μm; b1 and c1 are sections through the perispore.

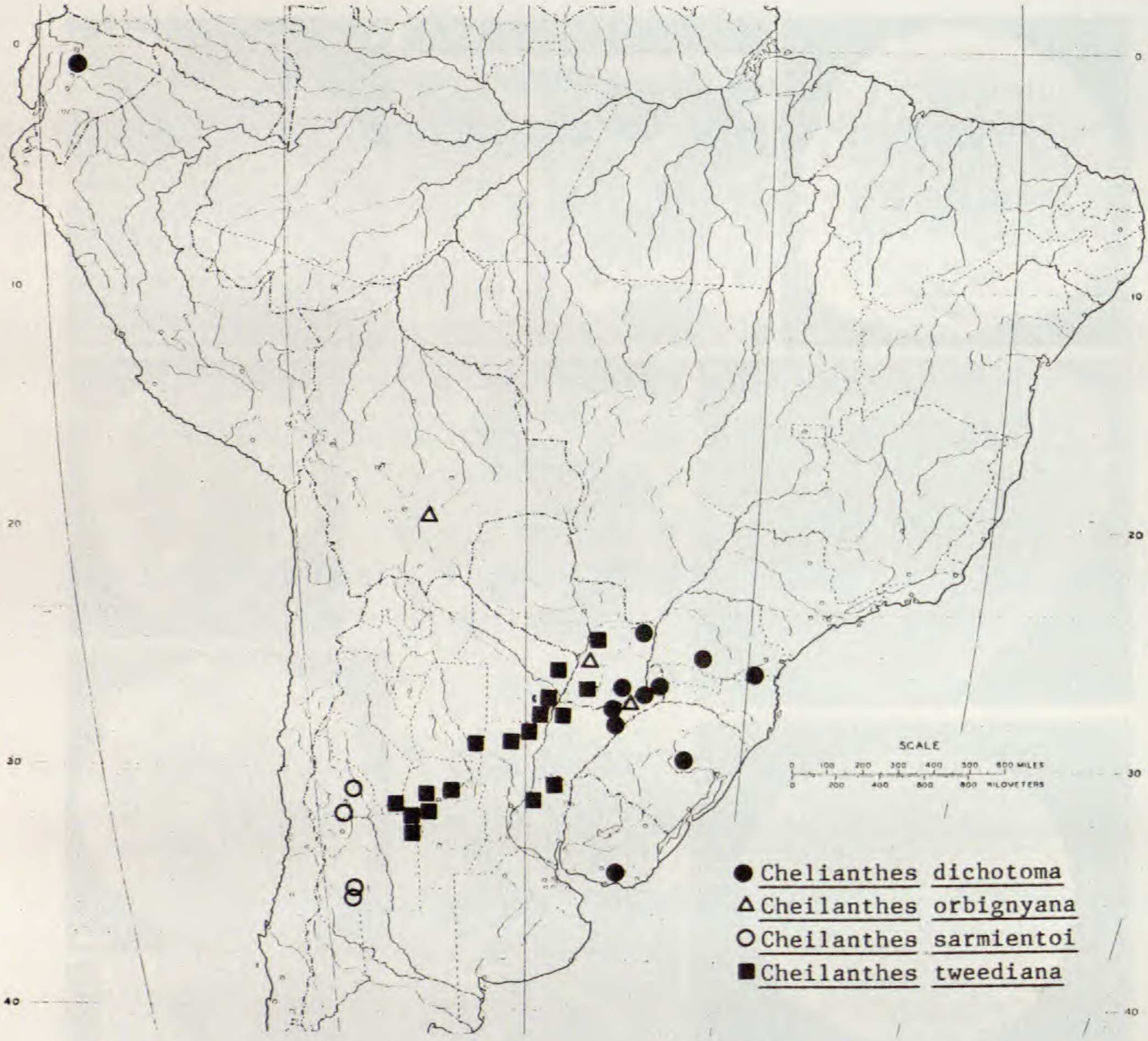


FIG. 2. Distribution of the *Cheilanthes dichotoma* group.

1. Rhizome scales concolorous, light reddish brown, soft; lamina bipinnate-pinnatifid, subcarnose; margin curved (lobed tips) with slightly modified, green pseudoindusium; glandular hairs red, 3-celled; spores olive ..... 3. *C. sarmientoi*

1. Rhizome scales bicolorous, dark reddish brown with hyaline or light brown margin, stiff; lamina 2–5-pinnate, herbaceous to chartaceous; margin curved with modified hyaline pseudoindusium; glandular hairs yellow to light brown, 2-celled; spores yellow to light brown.

   2. Rhizome long-creeping, slender; lamina linear-oblong, bipinnate; spores cristate, surface between cristae smooth ..... 4. *C. tweediana*

   2. Rhizome short or nodose, creeping; lamina ovate, 3–5-pinnate; spores cristate-reticulate, surface between cristae perforate to reticulate.

      3. Lamina 3-pinnate; rhachis straight; plants cespitose ..... 2. *C. orbignyana*

      3. Lamina 3–5-pinnate; rhachis zigzag; plants climbing or scrambling .... 1. *C. dichotoma*

1. *Cheilanthes dichotoma* Sw., Syn. fil. 129, 335, t. 3, f. 7. 1806.–*Adiantopsis dichotoma* (Sw.) T. Moore, Index fil. 17. 1857.–TYPE: Ecuador, Pcia. Pichincha, "Regnum Quitense, Monte St. Antonii", *Nee s.n.* (Holotype MA, not seen).–Figs. 3A–C, 1A, 1a.

Cheilanthes dichotoma has the widest distribution. It grows in southern Brazil, Paraguay, Uruguay, and northeastern Argentina, and also in Ecuador; surprisingly, there are no collections from Peru and Bolivia. Although Hooker (1858, p. 104) thought the Quito locality given by Swartz was likely in error, there is another Ecuadorian specimen in SI.

Representative specimens. **ECUADOR. Tungurahua.** Baños, 1700 m, *Herborn s.n.* (SI). **BRAZIL. Parana.** Mun. Guarapuava, Canto Galo, *Hatschbach 45247* (MBM); **Rio Grande do Sul.** Mun. Santa Cruz, Col. Guarany, 400 m, *Jürgens s.n.* (BAF, SI). **PARAGUAY. Alto Parana.** *Fiebrig 5903* (SI). **ARGENTINA. Misiones.** Cainguás, Mineral, *Schwindt 655* (GH). **Corrientes.** Estancia Rincón de las Mercedes, *Partridge s.n.* (BA). **URUGUAY. Maldonado.** Pan de Azúcar, *Osten 5697* (SI).

2. *Cheilanthes orbignyana* Mett. ex Kuhn, Linnaea 36:82. 1869.–TYPE: Bolivia, Pcia. La Laguna (now Padilla), *D'Orbigny 388* (Isotype P!).

Cheilanthes recurvata Baker, J. Bot. 16:299. 1878.–TYPE: Paraguay, Cerro Lambaré, Nov 1876, *Balansa s.n.* (Holotype K!, isotype SI!).–Figs. 3D–F, 1B, 1B1, 1b, 1b1.

This is new for Argentina. *Cheilanthes orbignyana* ranges from Peru and Bolivia to Paraguay and northeastern Argentina, but not Brazil.

Cheilanthes flexuosa Kunze, from central Brazil, looks very similar to *C. orbignyana* but differs by its hairlike rhizome scales and its unicellular to pluricellular simple hairs on the axes and blades. This species may belong to the *C. microphylla* group, but more study is needed.

Specimens studied. **PARAGUAY. Paraguari.** Cerro de Acahay, *Rojas 3006* (SI). **ARGENTINA. Misiones.** Candelaria, Santa Ana, *Albboff s.n.* (SI 22945).

3. **Cheilanthes sarmientoi** Ponce, sp. nov.–TYPE: Argentina, Pcia. San Juan, Depto. Sarmiento, Río de Los Sombreros, al NW de la desembocadura del Rio Los Leones, 24 Jan 1986, *Guaglianone 1528* (Holotype SI).–Figs. 4A–E, 1D, 1C1, 1c, 1c1.

Plantae 4–10 cm altae, rhizomatibus suberectis vel breviter repentibus cum squamis subulatis castaneis vel ferrugineis mollibus. Stipes fuscatus nitidus ad basin squamatus rubroglandulosis vel glabrescens, subsulcatus, quam lamina aequalibus vel longioribus. Lamina ovata vel anguste ovata, 2-pinnata-pinnatifida, subcarnosa, glandulosis, glandibus subsessilibus rubris saepe densis. Segmenta oblonga lobulata, margine revoluta leviter vel non modificata. Sporae globosae cristatae atrovirides.

Rhizome suberect, decumbent, or short-creeping, with linear-lanceolate or subulate, castaneous or red-brown scales. Fronds 4–10 cm long; stipe as long as the lamina or longer, with scales at the base and with rufous glandular hairs. Lamina ovate to narrowly ovate, pinnate-pinnatifid to 2-pinnate-pinnatifid, 1.5–3.5 cm wide, subcarnose, with glandular hairs, these shortly pedicellate, with a red or red-brown head, often dense on the lamina and on the axes; rhachis

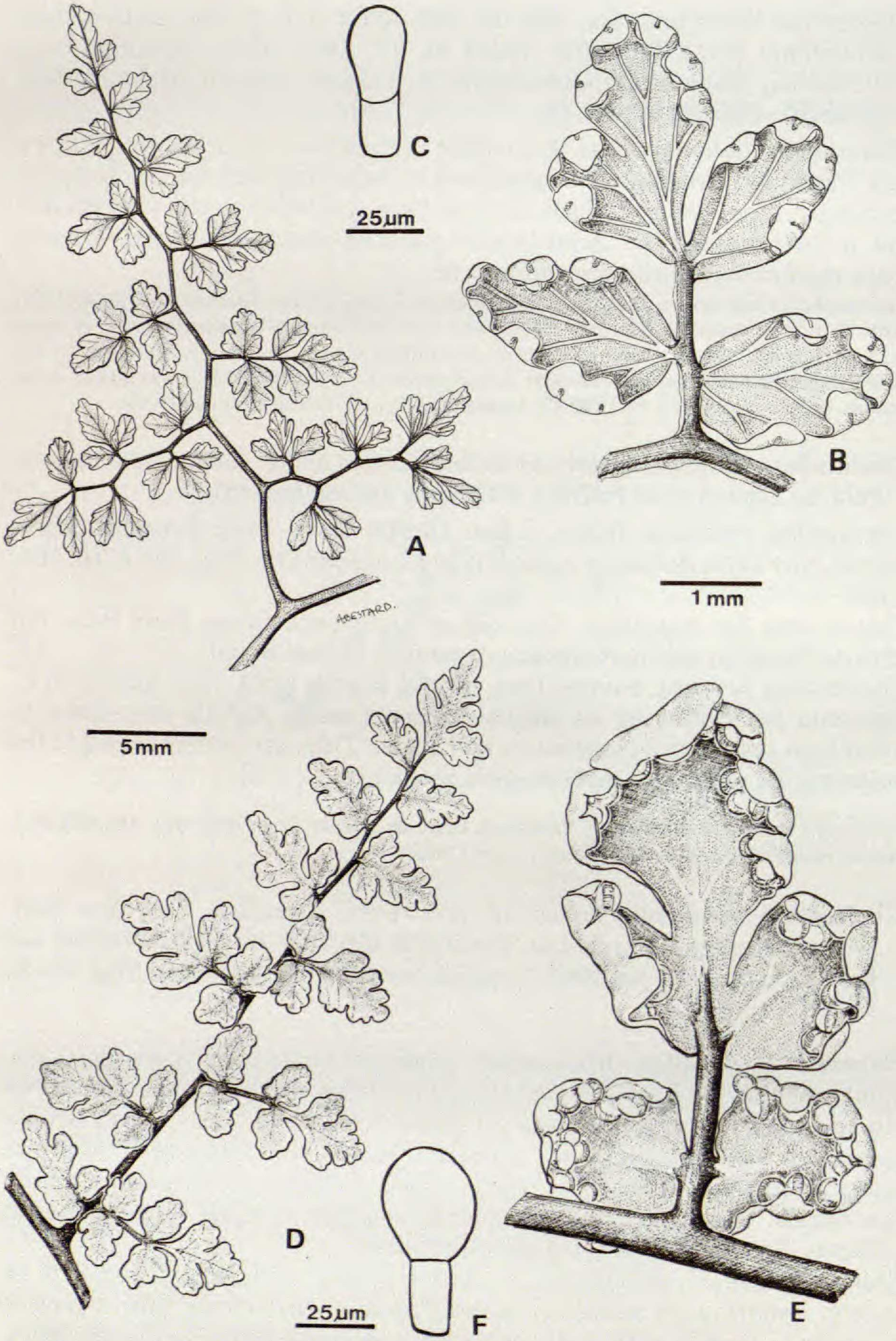
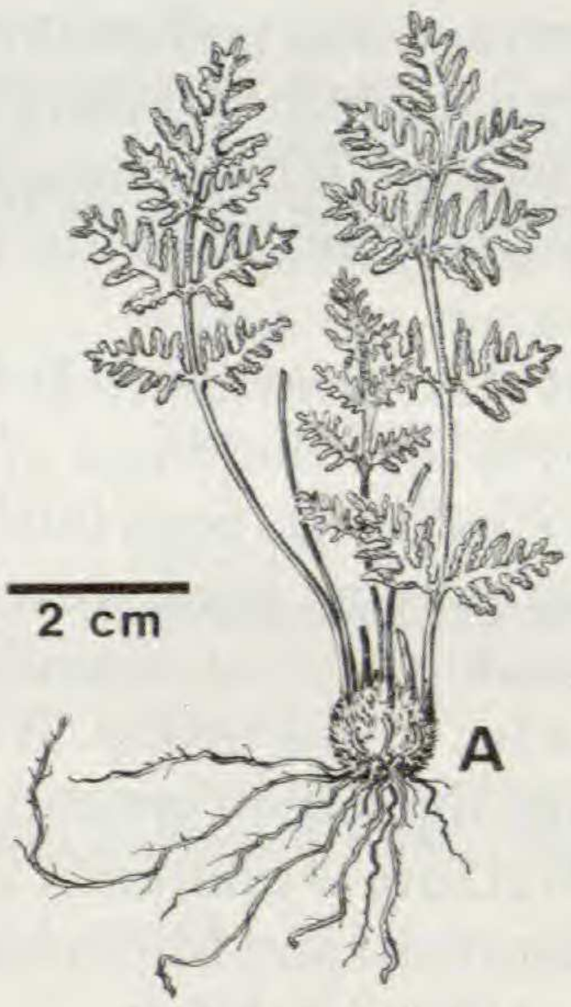
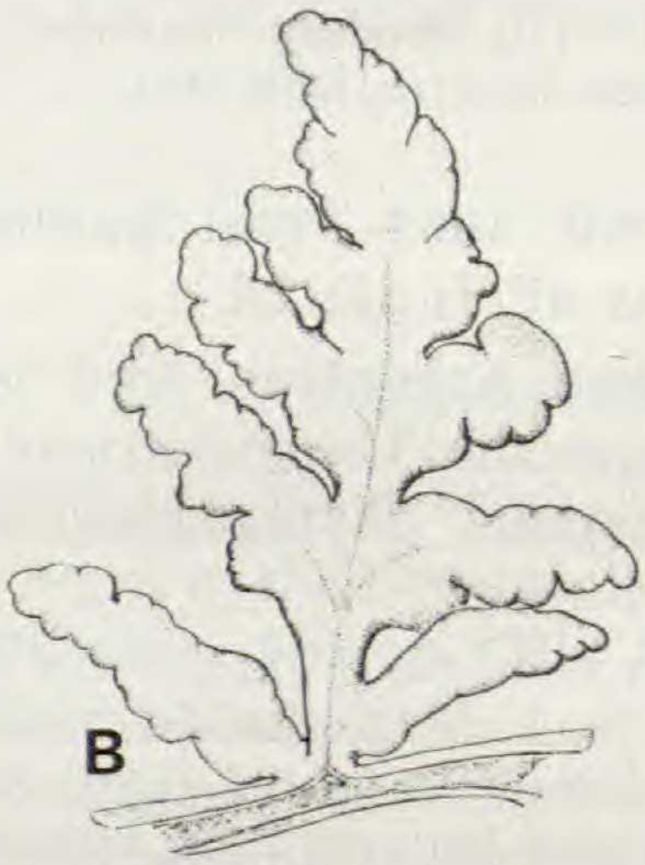
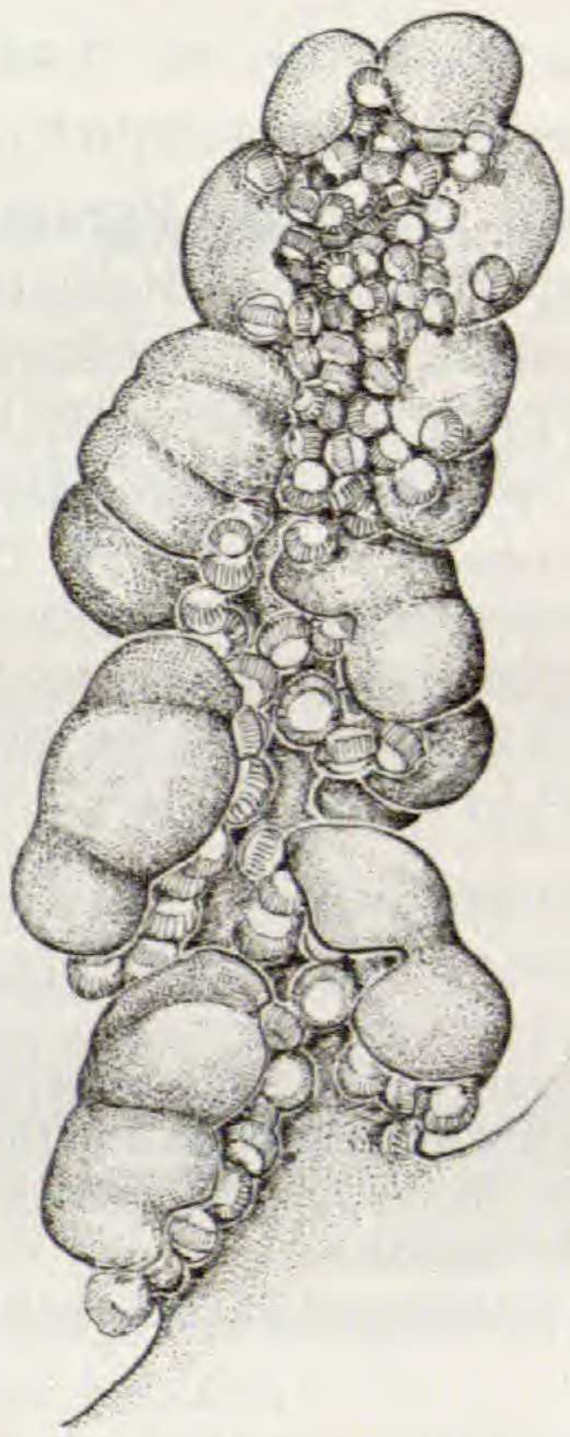


FIG. 3. A–C *Cheilanthes dichotoma* (*Mutinelli 14*, SI). A. Pinna. B. Ultimate segments. C. Glandular hair. D–F. *Cheilanthes orbignyana* (*Rojas 3006*, SI). D. Pinnae. E. Ultimate segments. F. Glandular hair.







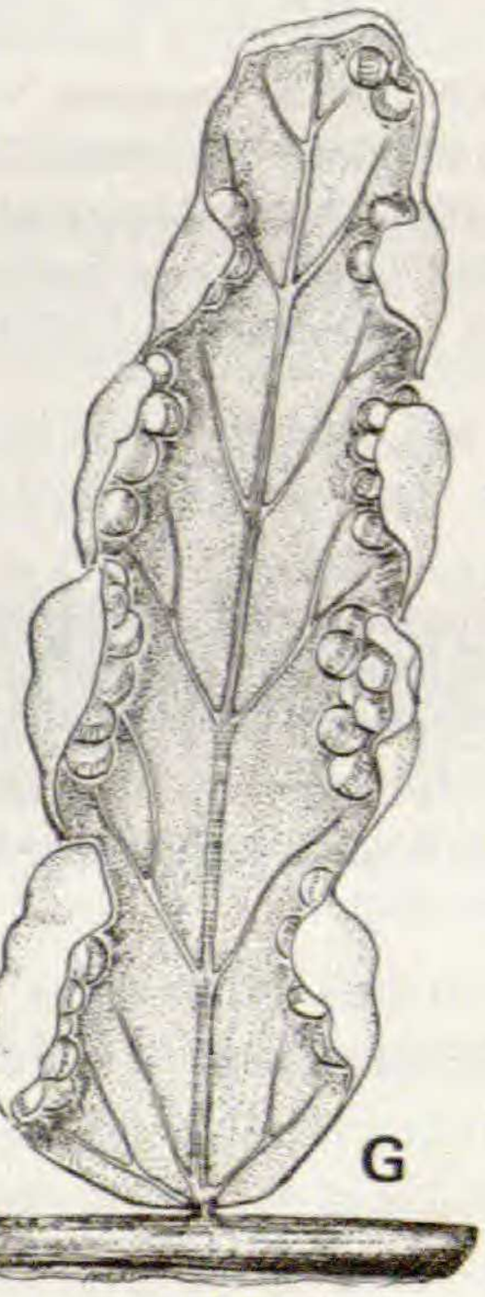


FIG. 4. A–E *Cheilanthes sarmientoi* (*Guaglianone 1528*, SI). A. Whole plant. B. Pinna. C. Ultimate segments. D. Margin detail. E. Glandular hair. F–H. *Cheilanthes tweediana* (*Hassler 208*, SI). F. Pinna. G. Ultimate segment. H. Glandular hair.

grooved with short sclerotic ribs. Pinnae ovate to narrowly ovate, pedicellate, remote; segments oblong, lobed or crenate, contracted, with the reflexed margin slightly modified. Sori on the vein-tips, protected by the reflexed lobes, laterally confluent at maturity. Spores globose, cristate, olive, 64–70.4 (av. 65.6) μm in diameter.

The specific name honors the Argentinian teacher and president D. F. Sarmiento (1811–1888), born in San Juan Province, and is also the name of a Department from where the plant was collected. The new species has been found only in the Cuyo region in the Andean precordillera at the extreme southwest of the range of the *C. dichotoma* group.

Cheilanthes sarmientoi is the most xeromorphic species of the group. It is reduced in size, has soft and dense rhizome scales to resist the barren ground, a thicker blade, and denser glandular hairs. Its perispore structure is unique in the group; a similar reticulate structure was mentioned by Morbelli and Michelena (1989) for *C. pruinata* Kaulf., which also grows in rocky and arid habitats.

Paratypes. **ARGENTINA. San Juan.** Jachal, Bella Vista, El Salto, *Kiesling & Meglioli 6689* (SI); Sarmiento, Quebrada del río Los Sombreros, *Kiesling & Sáenz 4175* (SI). **Mendoza.** San Rafael, Las Picaras, 1000–1500 m, *Ruiz Leal 7289* (LP); La Salvadora, El Nevado, *Ruiz Leal 6998* (BA).

4. *Cheilanthes tweediana* Hook., Sp. fil. 2:84, t. 96B. 1852–TYPE: Southern Brazil, río Paraná, *Tweedie s.n.* (Holotype K!).–Figs. 4F–H, 1D, 1d.

Cheilanthes tweediana grows in Paraguay and Argentina, and is a characteristic fern of Eastern Chaco and Highland Chaco, the "Chaco Serrano" of Cabrera (1976); it is also present in the neighboring "Espinal" phytogeographical province in northwestern Entre Ríos Province, Argentina.

Representative specimens. **PARAGUAY. Cordillera.** San Bernardino, *Hassler 208* (SI). **ARGENTINA. Formosa.** Villa Formosa, *Kurtz 1732* (SI). **Chaco.** San Fernando, Fontana, *Meyer 37* (SI). **Santiago del Estero.** Limite con Depto. 9 de Julio, Santa Fé, *Castellanos s.n.* (BA 47291). **Santa Fé.** Vera, Colonia Margarita, *Wolfhügel 41* (SI). **Corrientes.** Laguna Seca, *Kurtz 2011a* (SI). **Entre Ríos.** La Paz, Paso Yunque, *Burkart 25210* (SI). **Córdoba.** San Alberto, Mina Clavero, *Fabris 6758* (LP). **San Luis.** San Francisco, Las Chacras, *Castellanos s.n.* (BA 25/487).

ACKNOWLEDGMENTS

The authors thank Andrés Bestard and Victor Hugo Calvetti for careful illustration work, the SEM technicians of Museum of La Plata for assistance, and the curators of herbaria for the loan of the specimens. The first author also thanks Angel L. Cabrera for the revision of Latin diagnosis and Cecilia Ezcurra for revision of the English version.

This work was supported by the National Scientific and Technical Research Council (CONICET), Argentina.

LITERATURE CITED

BENHAM, D. M., M. D. WINDHAM, and R. H. HEVLY. 1988. *Astrolepis*, yet another new genus of cheilanthoid ferns. Amer. J. Bot. 75 (6, pt. 2):138.

CABRERA, A. L. 1976. *Regiones fitogeográficas Argentinas*. Ed. Acme. Buenos Aires.

GASTONY, G. J. and M. D. WINDHAM. 1987. The treatment and definition of agamosporous species. Amer. J. Bot. 74:707. (Abstract).

HOOKER, W. J. 1858. *Species filicum*, Vol. 2. London: William Pamplin.
MORBELLI, M. A. and I. G. MICHELENA. 1989. Palynological analysis of *Cheilanthes* Sw. species (Adiantaceae-Pteridophyta) of northwest of Argentina. Grana (in press).
TRYON, R. M. and A. F. TRYON. 1973. Geography, spores and evolutionary relations in the cheilanthoid ferns. In A. C. Jermy et al., eds., *The phylogeny and classification of the ferns*. J. Linn. Soc., Bot. 67(suppl.1):145–153.
——— and ———. 1982. *Ferns and allied plants, with special reference to tropical America*. New York: Springer-Verlag.
VIDA, G., A. MAYOR, and T. REICHSTEIN. 1983. Relations and evolution in *Cheilanthes* (Sinopteridaceae, Pteridophyta) in Macronesia and Mediterranean area, deduced from genome analysis of their hybrids. Acta Bot. Malacit. 8:101–126.
WINDHAM, M. D. 1986. Reassessment of the phylogenetic relationships of *Notholaena*. Amer. J. Bot. 73:742.
———. 1987. *Argyrochosma*, a new genus of cheilanthoid ferns. Amer. Fern J. 77:37–41.
WOLLENWEBER, E. 1985. Chemotaxonomic studies on cheilanthoid ferns. Taxon 34:355–356.

Review

"*Ferns of the Coastal Plain: Their Lore, Legends, and Uses*," by Lin Dunbar. 1989. xiv + 165 pp. Univ. of South Carolina Press, Columbia, SC 29208. $21.95. ISBN 0-87249-594-9.

This book covers the Atlantic coastal plain from Washington, DC south to the North Carolina border and then southwestward through Georgia to the Alabama and Florida borders. This area, therefore, includes a small part of Virginia, about half of North Carolina, and more than half of South Carolina and Georgia. Forty-six species of ferns growing in this region are accounted for by illustrations, informal descriptions, and fascinating ecological and ethnobotanical notes. The species are grouped according to frond division. Although no key to the species is included, they can be differentiated within groups by their illustrations and descriptions. A general introduction includes information on fern names, their life cycle and morphology, uses, and myths, folklore, and symbolism. A glossary, a bibliography, and an index to common and scientific names conclude the volume.

The author is an experienced plant hunter and forager with close ties to the people of the costal plain who are close to the land. Her book is a compendium of uses, lore, and mythology, both from local informants and sources distant in time and place. It is a wonderful introduction to the ofttimes separate worlds of taxonomy and ethnobotany and will be appreciated both by neophytes and experienced botanists. A paperback edition (ISBN 0-87249-595-7, $7.95) is also available.—DAVID B. LELLINGER, U.S. National Herbarium NHB-166, Smithsonian Institution, Washington, DC 20560.